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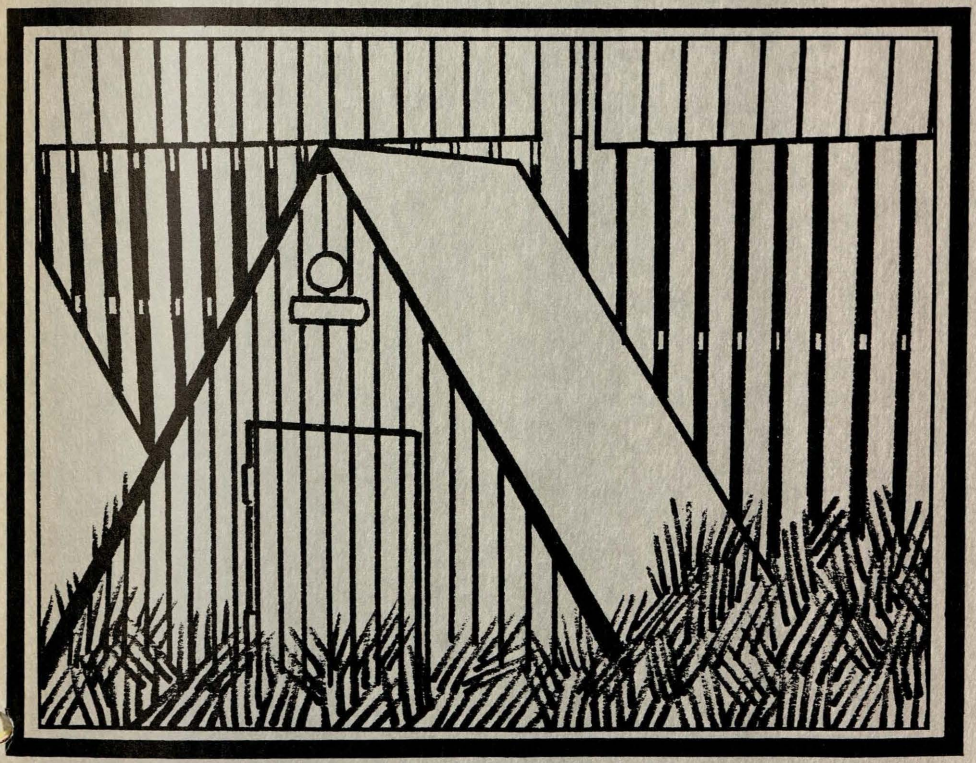
# the CHANGING MARKET for wood materials used in farm structures

DAVID C. BAUMGARTNER



NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE · U.S. DEPARTMENT OF AGRICULTURE

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## CONTENTS


The Study ..... 2

Permanent Buildings ..... 2

Farm Building Repairs ..... 4

Portable Structures ..... 5

Summary and Discussion ..... 6

# THE CHANGING MARKET FOR WOOD MATERIALS USED IN FARM STRUCTURES

David C. Baumgartner

The volume of lumber used in farm building construction declined from 4.5 billion board feet in 1952 to 2 billion board in 1962.[1] This much decline in a traditionally large market for lumber has been attributed to several factors, including a reduction in the number of farm buildings constructed annually, changes in building construction types, and the substitution of other wood and nonwood products for lumber (table 1).

*Table 1.—Lumber, plywood, and veneer consumed in farm structures, 1952-1962*[1]

| Year | Lumber | | Plywood and veneer | |
|---|---|---|---|---|
| | Volume | Use per dollar[2] of expenditure | Volume used | Use per dollar of expenditure |
| | Million board-ft. | Board-ft. | Million sq. ft. 3/8-inch basis | Sq. ft. 3/8-inch basis |
| 1952 | 4,500 | 2.47 | -- | -- |
| 1962 | 2,000 | 1.41 | 210 | 0.15 |

1/ Includes farm service buildings and structures; excludes dwellings. Source: USDA Forest Serv., Forest Resource Rep. 17, 235 p. 1965.
2/ 1961 dollars.

In 1949 over 800,000 new farm service buildings were constructed (see footnote 1), whereas during the agriculture census survey years 1958-1960 about 194,000 were built annually, excluding dwellings and silos. During the census survey years 1963-1965, the average number constructed had declined further to 160,666 per year. Although about 17 percent fewer buildings were built during the 1965 survey period than in the 1960 period, the average size of all new farm service buildings (excluding silos and grain storage buildings) increased from 1,590 square feet to 1,775, or about 11.5 percent.[2]

Changes in the type of structures needed on the larger, more specialized, modern farms have also contributed to the decline in lumber use. Examples are the increase in construction of pole type barns with metal roofs and siding and hog confinement buildings built primarily of metal and concrete.

The increasing subsitution of plywood, building board, and nonwood materials has also caused a decline in lumber consumption. The importance of this substitution effect can be emphasized by the fact that investment in farm buildings, expressed as a percentage of gross farm product, has been a fairly stable long-term function and is expected to continue as such (table 2).

Significant changes in farm building construction and materials use have taken place during the last two decades. To gain insight into the future use of wood in this sector of the construction industry, this farm structures study was undertaken.

[1] *U. S. Department of Agriculture, Forest Service. Timber Trends in the United States. USDA Forest Ser., Forest Resource Rep. 17, 235 p. 1965.*

[2] *U. S. Dep. of Commerce, Suppl. 1, 1964 Census of Agriculture, III, Part 3. Sample Survey of Agriculture 1969.*

*Table 2.—Farm output and construction expenditures, 1920-1962[1] and projections, 1970-2000.*

*(1960 dollars)*

| Period or year | Gross farm product (GFP) | Construction expenditures[2]: Total | New structures | Repairs | Construction expenditures as a percent of GFP |
|---|---|---|---|---|---|
| | Million dollars | Million dollars | Million dollars | Million dollars | Percent |
| 1920-29[3] | 14,800 | 920 | 480 | 440 | 6.2 |
| 1930-39[3] | 15,600 | 620 | 210 | 410 | 4.0 |
| 1940-49[3] | 17,800 | 1,060 | 620 | 440 | 6.0 |
| 1950-59[3] | 19,200 | 1,540 | 1,040 | 500 | 8.0 |
| 1960 | 20,900 | 1,310 | 890 | 420 | 6.3 |
| 1961 | 21,400 | 1,470 | 980 | 490 | 6.9 |
| 1962 | 21,600 | 1,420 | 950 | 470 | 6.6 |
| 1970 | 23,500 | 1,530 | 1,060 | 470 | 6.5 |
| 1980 | 25,800 | 1,680 | 1,160 | 520 | 6.5 |
| 1990 | 28,500 | 1,850 | 1,280 | 570 | 6.5 |
| 2000 | 31,500 | 2,050 | 1,420 | 630 | 6.5 |

1/ Source: USDA Forest Serv., Forest Resource Rep. 17, 235 p. 1965.

2/ Includes farm service buildings and structures; excludes dwellings.

3/ Data shown are annual averages for the decade.

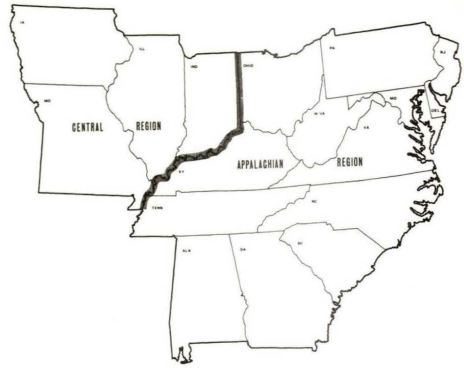



*Figure 1.—Seventeen-State study area including the Central and Appalachian Regions.*

## THE STUDY

During the summer of 1966, the Forest Service in cooperation with Doane Agriculture Service conducted a study of farm building construction activities for the years 1963 through 1965. The study included a sample of commercial farms[3] in the Central and Appalachian Regions of the United States (fig. 1). Questionnaires were mailed to all 1,600 members of the Doane Farm Panel, which is carefully selected by stratified sampling techniques to represent the commercial farm market. The panel is periodically checked and rebalanced on the basis of the Census of Agriculture. To insure that the panel is properly maintained, annual characteristic surveys are conducted and checks of reporting accuracy are made regularly.

Results from 1,348 usable questionnaires, obtained from farmers in the 17-State area, are presented in three general divisions: permanent buildings, farm building repair, and portable structures.

[3] *Commercial farms are defined for this study as farms having total farm products sales of $2,500 or more in 1964.*

## PERMANENT BUILDINGS

### Number and Type of Buildings

During the 3-year study period, 247,000 new permanent farm buildings were constructed within the 17-State study area — 131,000 were built in the Central Region and 116,000 in the Appalachian Region. The survey classified 25 basic types of permanent farm buildings according to 4 basic frame construction types. Under each frame type, several types of exterior wall construction materials were listed.

In the entire 17-State area, grain storage and machine storage buildings were the most frequently constructed types, accounting for about 29 percent of all new buildings (fig. 2). Farmhouses were third, accounting for 8 percent of all new construction, but no other type accounted for more than 7 percent of the total buildings. Machine storage buildings accounted for high percentages in both the Central (20 percent) and Appalachian (16 percent) Regions. Grain storage buildings, however, accounted for 17 percent in the Central Region, as opposed to only 4 percent in the Appalachian Region. This difference in the number of grain storage

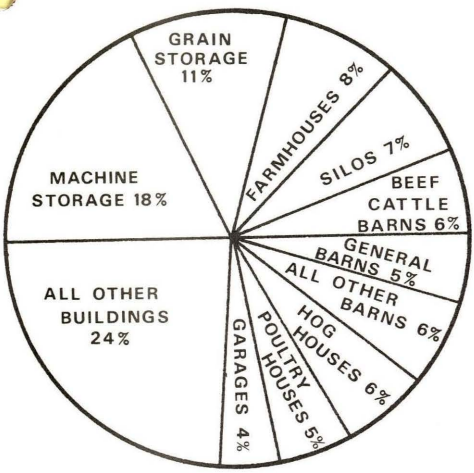



*Figure 2.—Percentage of buildings in general categories.*

buildings was offset by a much higher percentage of poultry houses in the Appalachian Region, other types of structures accounting for similar percentages in both regions. General barns, beef cattle barns, silos, and corn cribs each accounted for slightly more than 5 percent of the total.

Poultry houses had the largest floor area of all building types constructed. They averaged nearly 2,700 square feet of floor area in the Central Region and over 4,800 square feet in the Appalachian. Broiler houses (all built in the Appalachian Region) averaged over 12,000 square feet. General barns, beef cattle barns, and dairy barns were the next largest types, each averaging between 2,000 and 2,500 square feet in both regions.

## Frame and Wall Construction

In the 17-State area, six basic frame-exterior wall combinations predominate. They are shown as follows:

| *Frame type* | *Exterior wall type* | *Percent of all buildings* |
|---|---|---|
| Lumber | Lumber | 24 |
| Wood pole | Metal | 16 |
| Metal | Metal | 13 |
| Masonry | Concrete block | 13 |
| Lumber | Metal | 11 |
| Wood pole | Lumber | 9 |
| Six most popular types | | 86 |
| Thirteen other types | | 14 |
| | | 100 |

Buildings with both frame and exterior walls made of lumber were still the most common type, but metal was the predominant exterior wall material when all frame types were considered — 41 percent of all new buildings had metal exterior walls. Of the two most popular building types, more than three-fourths of the grain storage buildings were made entirely of metal and another 10 percent had metal exterior walls. Machine storage buildings (fig. 3) were largely of lumber or wood pole frame, with exteriors evenly divided between wood and metal. The Central Region had more wood pole-metal, all metal, and lumber-metal buildings; the Appalachian Region had more all-lumber, masonry-concrete, and wood pole-lumber buildings.

*Figure 3.—Machine storage building with wood-pole frame and metal exterior walls. (Photo courtesy of University of Illinois, Department of Agricultural Engineering)*

### Source of Building Plans

Fifty-eight percent of the new buildings were built from the farm operator's own plans. Building materials dealers supplied about 13 percent of the plans and university extension services supplied 9 percent. Manufacturers, professional architects, and local contractors provided 16 percent of the plans. This response may be misleading since it was impossible to tell where farmers acquired their ideas for their "own" plans, or where plans from dealers and contractors originated. Grain storage buildings and silos were the least likely to be built from the farm operator's own plans. Farmhouses, dairy cattle barns, milk parlors, poultry brooder and broiler houses, and hay storage buildings were also less likely to be designed by the farm operator himself.

### Builders

Nearly 40 percent of the new buildings in the 17-State area were built by someone other than the farmer himself. Independent contractors constructed nearly one-fourth of all buildings and building materials dealers 13 percent. More recent estimates[4] suggest that the percentage built by persons other than the farm operator himself may be much higher now than during the survey years. About 10 percent more buildings were built by the farm operator in the Appalachian Region than in the Central Region. Poultry broiler and brooder houses, silos, milk parlors, farmhouses, and grain storage buildings were the least likely to be constructed by farm operators.

### Form of Wood Materials Used

Nearly three-fourths of the wood materials used in new farm buildings were purchased in unassembled and uncut form. About 7 percent of the wood was purchased precut and only about 5 percent (mainly roof trusses) in prefabricated form. Regional differences in the form of wood used were not large. Poultry brooder and broiler houses were the most frequent users of prefabricated wood components. More than 23 percent of the brooder houses had prefabricated roof trusses and about 8 percent had both wall panels and roof panels prefabricated. About 39 percent of the broiler houses had prefabricated roof trusses. Farmhouses, sheep barns, hay storage, machine storage, and utility buildings were the other major users of prefabricated wood components.

### Sources of Wood Materials

Lumberyards provided the wood materials for about 42 percent of all buildings constructed in the 17-State area, and sawmills for about 20 percent. In the Appalachian Region, about one-third of the new buildings were constructed with wood obtained from sawmills as compared to only 6 percent in the Central Region. This was probably due to the availability of softwood lumber at local mills in the Appalachian Region. Contractors supplied the wood materials for 5 percent of the buildings and about 4 percent used wood cut on the farm. About one-fifth of the new buildings contained no wood.

## FARM BUILDING REPAIRS

In addition to the new buildings constructed in the 17-State area, an estimated total of 193,000 existing buildings were repaired or remodeled during the 3-year period. Only those repair jobs involving a materials cost of $100 or more are included in this total. Nearly two-fifths of the buildings repaired were farmhouses. General barns accounted for 16 percent of buildings repaired and dairy barns for 7 percent. Poultry laying houses and corn cribs were the only other building types accounting for as much as 5 percent of all repair jobs. About 10 percent more repair jobs were reported in the Appalachian Region, although the Central Region reported a larger number of new buildings. The following tabulation shows the combinations of materials used in repair jobs and their frequency of use in the 17-State area.

[4] *Farm Building News, p. 8, November 1969.*

| | *Percent frequency* |
|---|---|
| Lumber only | 25 |
| Metal and Lumber | 24 |
| Lumber and plywood | 17 |
| Metal only | 7 |
| Metal and plywood | 5 |
| All other combinations | 22 |
| | 100 |

Regional differences in materials used in repairs were very minor.

## PORTABLE STRUCTURES

### Number and Type of Structures

Portable structures also represent an important segment of farm building construction. More than 1.3 million portable structures were added in the 17 States during the 3-year study period. Approximately one-half of these structures were purchased as ready-made units. Structures used for hogs (473,000), and for poultry (468,000), accounted for over 70 percent of the total (fig. 4). Most of the poultry structures, however, were feeders and laying nests which are very small. Among the hog structures, self feeders, troughs, "A" and shed-type houses (fig. 5), and farrowing crates all accounted for large numbers. Nearly twice as many hog structures were added in the Central Region as in the Appalachian, while the Appalacian Region had nearly all of the poultry portables. Other portable structures included 123,000 cattle structures, 17,000 sheep structures, and 221,000 miscellaneous structures (mainly gates).

### Materials Used in Portable Structures

Structures made entirely of metal or entirely of lumber occurred in equal numbers and accounted for over 80 percent of all the portables. Combinations of metal and lumber were used for 12 percent and lumber and plywood for 5 percent. Metal was the most popular material for hog feeders and farrowing crates, and poultry feeders and brooders. Nearly all (94 percent) of the metal structures were fabricated before purchase. Lumber was the predominate material used for hog houses, troughs, feeding stalls and loading chutes, sheep shelters, poultry laying nests, cattle feeders and loading chutes, and truck racks. About 87 percent of the "lumber only" structures were built on the farm.

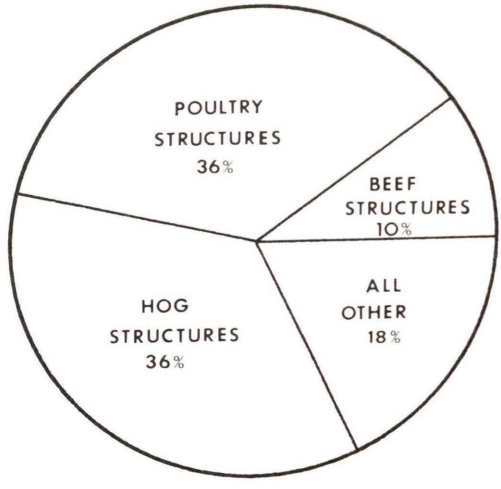
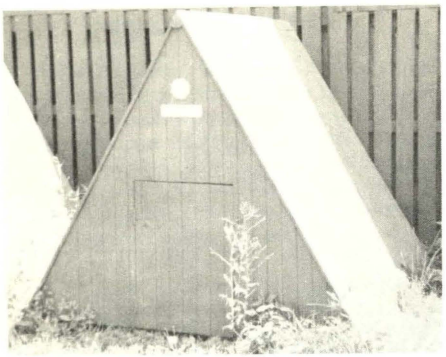



*Figure 4.—Percentage of portable structures in general categories.*

### Source of Materials

Of the 643,000 portable structures built on the farm, about 65 percent were constructed with materials obtained from building materials dealers. Sawmills provided the materials for 27 percent and scrap materials were used for 5 percent.

Building materials dealers sold 50 percent of the 660,000 portable structures which were purchased complete and 40 percent were purchased from farm stores. About 8 percent were purchased secondhand from other farmers.



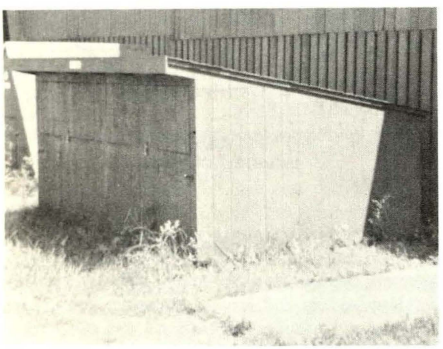


*Figure 5.—"A" and shed-type portable hog houses. (Photo courtesy of University of Illinois, Department of Agricultural Engineering)*

## SUMMARY AND DISCUSSION

The decline in the use of lumber on farms cannot be attributed entirely to a reduced rate of farm building construction. Although the number of farm buildings constructed annually has declined rapidly since 1949, the buildings have been larger, and declines in the annual total square footage of farm buildings have been much slower. The value of investment in farm buildings expressed as a percentage of gross farm product has been fairly stable. It is clear that a good deal of the decline in lumber used on farms has been caused by the increasing use of other materials, both wood and nonwood.

Grain and machine storage buildings both contained large amounts of metal and accounted for about 30 percent of all new farm buildings in the Central and Appalachian Regions during the years 1963-1965. Buildings with both frame and exterior walls made of lumber were still the most common type, but metal was the predominant exterior wall material when all frame types were considered — 41 percent of all the new buildings had metal exterior walls.

A large and increasing number of farm buildings are built by contractors and manufacturers rather than by the farm operator. This trend may be associated with declines in wood use, since the nonfarmer builders are capable of using a wider range of materials than are farm operators. About 40 percent of the new farm buildings were constructed by persons other than the farm operator during the 1963-1965 period. It is apparent that contractors and manufacturers exert considerable influence on building design and material use.

The importance of nonfarmer builders also applies to the construction of portable farm structures. Approximately one-half of all new portables added during the 3-year study period were purchased complete. Structures made entirely of metal or entirely of lumber occurred in equal numbers and accounted for over 81 percent of all the portables. Nearly all (94 percent) of the metal structures were purchased complete, while about 87 percent of the lumber structures were built on the farm.

Most wood materials were purchased in unassembled and uncut form from lumberyards and sawmills. These traditional forms and marketing channels for wood materials may not be adequate to serve the needs of building contractors or today's farmer builder who needs convenient, ready-to-use components. In order to encourage more effiicient use of wood in farm buildings, promotional efforts should be directed toward farm building contractors and manufacturers, and toward marketing wood materials in more convenient forms at more convenient locations.

## SOME RECENT RESEARCH PAPERS OF THE NORTH CENTRAL FOREST EXPERIMENT STATION

Skiing in the Great Lakes States: The Industry and the Skier, by William A. Leuschner. USDA Forest Serv. Res. Pap. NC-46, 42 p., illus. 1970.

Proceedings of the Ninth Lake States Forest Tree Improvement Conference, August 22-23, 1969. USDA Forest Serv. Res. Pap. NC-47, 34 p. 1970.

A Water Curtain for Controlling Experimental Forest Fires, by Von J. Johnson. USDA Forest Serv. Res. Pap. NC-48, 7 p., illus. 1970.

Wilderness Ecology: A Method of Sampling and Summarizing Data for Plant Community Classification, by Lewis F. Ohmann and Robert R. Ream. USDA Forest Serv. Res. Pap. NC-49, 14 p., illus. 1971.

Predicting Lumber Grade Yields for Standing Hardwood Trees, by Charles L. Stayton, Richard M. Marden, and Glenn L. Gammon, USDA Forest Serv. Res. Pap. NC-50, 8 p. 1971.

Tables of Compound-Discount Interest Rate Multipliers for Evaluating Forestry Investments, by Allen L . Lundgren. USDA Forest Serv. Res. Pap. NC-51, 142 p., illus. 1971.

Ecological Studies of the Timber Wolf in Northeastern Minnesota, by L. David Mech and L. D. Frenzel, Jr. (Editors). USDA Forest Serv. Res. Pap. NC-52, 62 p., illus. 1971.

Pest Susceptibility Variation in Lake States Jack-Pine Seed Sources, by James P. King. USDA Forest Serv. Res. Pap. NC-53, 10 p., illus. 1971.

Influence of Stand Density on Stem Quality in Pole-size Northern Hardwoods, by Richard M. Godman and David J. Books. USDA Forest Serv. Res. Pap. NC-54, 7 p., illus. 1971.

The Dynamic Forces and Moments Required in Handling Tree-length Logs, by John A. Sturos. USDA Forest Serv. Res. Pap. NC-55, 8 p., illus. 1971.

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- Participating with all State forestry agencies in cooperative programs to protect, improve, and wisely use our Country's 395 million acres of State, local, and private forest lands.
- Managing and protecting the 187-million acre National Forest System.

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